REMARKS

Claims 1, 2, 5, 6 and 8-13 are pending in the present application. Claims 1, 2, 5 and 6 are herein amended. Claims 3, 4 and 7 are cancelled. Claims 8-13 are newly added.

Specification Objection

The abstract of the disclosure was objected to. The abstract has been amended to comply with USPTO patent practice.

Claim Rejections - 35 U.S.C. § 103

The invention of the present application is a composite in which a thermoplastic resin composition, specifically a thermoplastic resin composition containing a polyphenylene sulfide as a component thereof, is integrally bonded by injection molding directly to the surface of a shaped aluminum alloy material.

As pretreatment for this bonding, the shaped aluminum alloy material is brought into contact with an aqueous solution having dissolved therein at least one compound selected from the group consisting of ammonia, hydrazine, and a water-soluble amine compound. Through this treatment, for example, as shown in the attached photograph, minute holes can be formed. It has been verified by the present inventors that these minute holes are minute depressions of diameter approximately 0.01 to 0.1 μm, and the density of these depressions per square μm is 50 to 500 for those of diameter 0.01 to 0.03 μm, and 10 to 50 for those of diameter 0.03 to 0.1 μm. (*See* attached photograph.)

The following reaction takes place:

$$Al + OH^- + H_2O \rightarrow 3/2\ H_2 \uparrow + AlO_2^-$$

Through this reaction, the aluminum dissolves to form the above minute holes. Furthermore, upon dipping the aluminum alloy in such an aqueous ammonia solution, rinsing with water and drying, and then analyzing the surface of the aluminum alloy by X-ray photoelectron spectroscopy (XPS), nitrogen atoms are detected on the surface of the aluminum alloy. It is presumed that this is effective in the joining by the injection molding. (*See* specification.) Specifically, with an aluminum alloy not subjected to the above liquid treatment, nitrogen atoms are not observed with XPS. The nitrogen atoms detected through the XPS thus do not originate from nitrogen in the air, but rather are due to the amine compound used in the liquid treatment.

It is presumed that the amine compound remaining on the surface of the aluminum alloy and the injected polyphenylene sulfide undergo an exothermic reaction, and the polyphenylene sulfide melts through this exothermic reaction and infiltrates into the minute depressions before completely cooling, and then crystallizes and solidifies, thus giving rise to the bonding strength. As a result, the anchoring effect is greater than with conventional adhesion.

With the invention of the present application, the minute holes are filled with the resin more easily under the pressurized conditions due to the "injection molding."

Claim 1 has been amended with regard to "an aqueous solution of ammonia, hydrazine, or a water-soluble amine compound", "polyphenylene sulfide", and "forming by injection molding." Support for the amendment is in the specification at, *e.g.*, page 3, lines 10-20.

A. Rejection based on Kallenbach in view of Scott

Claims 1-4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over **Kallenbach** (US 5,212,214) in view of **Scott** (US 3,531,332). Favorable reconsideration is requested.

Applicants respectfully submit that Kallenbach in view of Scott does not teach or suggest:

> a shaped aluminum alloy material that has been subjected to a dipping process in which it is dipped in a 3 to 10% hydrazine monohydrate aqueous solution at 40 to 70°C, said shaped aluminum alloy material having fine recesses with a diameter of 30 to 300 nm on the surface of said shaped aluminum alloy material

as recited in amended claim 1 and similarly recited in amended claim 2, and the similar method step as recited in claims 5 and 6.

Kallenbach discloses an arylene sulfide polymer resin coating composition, and a coating method which utilize arylene sulfide polyer resin compositions. As acknowledged by the Office Action, Kallenbach does not disclose the treatment of a shaped aluminum alloy material as recited in the claims. (Office Action, page 3.) The Office Action cited Scott for teaching the treatment as recited in the claims.

Scott discloses a process for the treatment of aluminum by contacting alumina from 5 seconds to less than 15 seconds with a solution consisting essentially of purified water and from 0.001 to 0.3 wt % of a substance selected from the group consisting of triethanolamine, diethylenetriamine and hydrazirie which maintains an aqueous solution pH in the range of 7 to 11, said solution being at a temperature of 85°C to boiling and a pH of 7 to 11, and then applying

an organic coating to the so-treated aluminum, the treatment resulting in said coating having improved adherence to said aluminum.

Generally, a hydroxide layer is formed on the surface of the aluminum when alumina is dipped in hot water. The hydroxide layer is called boehmite (AlO (OH). It is known that the boehmite (AlO (OH) is formed in an environment of hot water or vapor at a temperature of about 90°C to 130°C, and an amine compound encourages catalytic reaction. The boehmite (A1O (OH) on the surface of an aluminum alloy is for providing a good surface for treating aluminum or aluminum base alloys which renders the metal susceptible to further coating processes. (*See* Scott, col. 2.)

Thus, Scott discloses, in example 1, that samples of aluminum alloy are cleaned followed by 15 seconds immersion in 100°C solutions of amines. (Col. 6, lines 20-26.) Boiled amines at 100°C will not be on the surface of aluminum alloy because of the high temperature.

On the other hand, an aluminum alloy material in the present invention, is dipped in "a hydrazine monohydrate aqueous solution at 40 to 70°C," and the process finely etches the aluminum alloy surface to thereby form fine recesses and projections thereon and to adsorb such a nitrogen-containing compound on the aluminum alloy surface. (*See* specification, page 12, lines 10-17.)

As a result, an exothermic reaction takes place when the polyphenylene sulfide composition contacts the chemisorbed substances and the composition may enter the fine recesses on the aluminum alloy surface without rapidly cooling to become solidified. (*See* specification, page 3, line 9 to page 5, line 4.)

The layer of the present invention forms natural aluminum oxide ($A1_2O_3$) on the surface of the aluminum, when an alumina is dipped in water or the like of 40 to 70°C, and amines remain on the surface of the aluminum by chemisorption. The natural aluminum oxide ($A1_2O_3$) layer is stronger and steadier than the boehmite (A1O (OH) layer.

Neither Kallenbach nor Scott discloses the treatment process and the resulting structure of the shaped aluminum alloy material as recited in the present claims, and thus, the present claims are non-obvious over Kallenbach in view of Scott.

B. Rejection based on Haak in view of Scott

Claims 1-7 were rejected under 35 U.S.C. § 103(a) as being unpatentable over **Haak** (US 2001/0036559) in view of **Scott** (US 3,531,332). Favorable reconsideration is requested.

Applicants respectfully submit that Haak in view of Scott does not teach or suggest:

> a shaped aluminum alloy material that has been subjected to a dipping process in which it is dipped in a 3 to 10% hydrazine monohydrate aqueous solution at 40 to 70°C, said shaped aluminum alloy material having fine recesses with a diameter of 30 to 300 nm on the surface of said shaped aluminum alloy material

as recited in amended claim 1 and similarly recited in amended claim 2, and the similar method step as recited in claims 5 and 6.

Haack discloses a component made from long-fiber-reinforced thermoplastics and characterized by bonding between metal structure and plastic structures. As acknowledged by the Office Action, Haak does not disclose the treatment of a shaped aluminum alloy material as recited in the claims. (Office Action, page 3.) The Office Action cites Scott for teaching that the treatment would have been obvious.

For the reasons stated above, Applicants respectfully submit that Scott does not teach the treatment as recited in the claims. Neither Haak nor Scott discloses the treatment process and the resulting structure of the shaped aluminum alloy material as recited in the present claims, and thus, the present claims are non-obvious over Haak in view of Scott.

For at least the foregoing reasons, claims 1, 2, 5, 6, 8-13 are patentable over the cited references. Accordingly, withdrawal of the rejections of claims 1, 2, 5 and 6 is requested.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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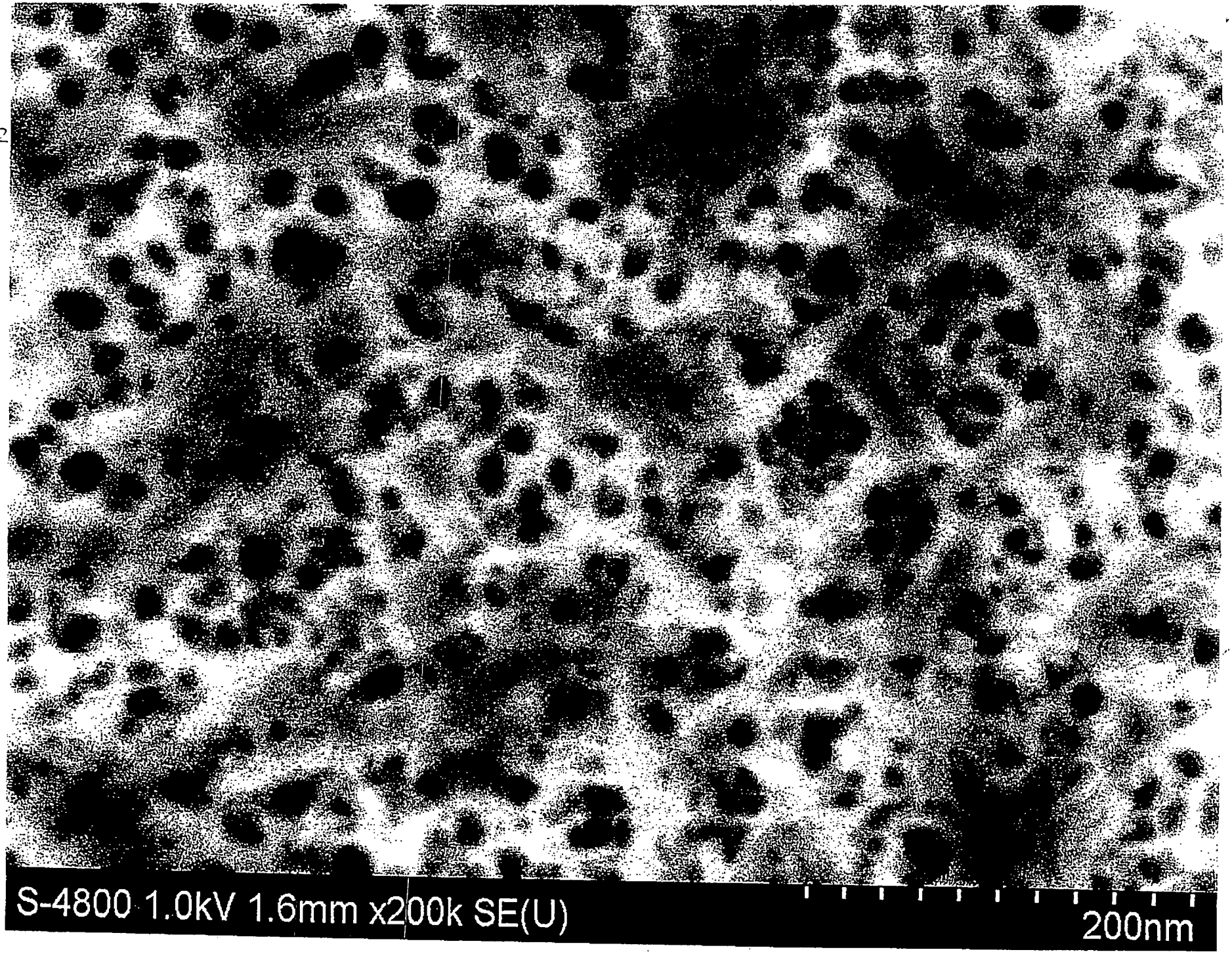
AGM/adp
Attachment: Photograph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